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Annulohypoxylon bawanglingense, *A. diaoluoshanense*, *A. guangxiense,* and *A. sichuanense* spp. nov. and new records from China

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Abstract—Four new species—*Annulohypoxylon bawanglingense, A. diaoluoshanense, A. guangxiense,* and *A. sichuanense*—are described, and *A. maeteangense* and *A. substygium* are recorded as new to China.

Key words—*Ascomycota,* pyrenomycetous fungi, taxonomy, *Hypoxylaceae, Xylariales*

Introduction

We describe four new species of *Annulohypoxylon* and two new *Annulohypoxylon* records from China. These specimens are conserved in the Herbarium Mycologicum Academiae Sinicae, Beijing, China (HMAS).

Materials & methods

The specimens were examined using a Motic SMZ-168 stereomicroscope. Microscopic features of asci and ascospores were described from slide preparations mounted in water and Melzer's reagent, and measurements were made from 20 ascospores using a Zeiss Axioskop 2 plus compound microscope. Stromata were photographed using a Sony NEX-7 digital camera.

Taxonomy

Annulohypoxylon bawanglingense Wei Li bis & L. Guo, **sp. nov.** Figs 1–3

FN 570628

Differs from *Annulohypoxylon moriforme* by its larger ascospores, and from *A. microdisicum* by its larger disc on the ostiole.

Type: China, Hainan, Changjiang, Bawangling, alt. 490 m, on the wood of the *Adenanthera microsperma* Teijsm. & Binn. (*Leguminosae*), 17.II.2017, L. Guo 12112 (**Holotype**, HMAS 248019).

Etymology: The epithet refers to the type locality, Bawangling.

Stromata pulvinate to effused-pulvinate, with conspicuous perithecial mounds, up to ¼ exposed, 0.2–17 × 0.15–3.5 cm, 0.9–1.5 mm thick; surface brownish black; blackish brown granules immediately beneath surface, shiny, with KOH-extractable greenish olivaceous pigment; the tissue below the perithecial layer inconspicuous, black. Perithecia subspherical to obovate, 0.35–0.5 mm diam. Ostioles papillate, encircled with a *truncatum*-type disc, 0.35–0.5 mm diameter. Asci 119–170 µm long overall, the spore-bearing parts 80–100 × 4–5 µm above 40–70 µm long stipes; apical ring bluing in Melzer's iodine reagent, discoid, 1–1.5 µm high, 1.5–2 µm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 8–11 × 3.5–4 µm, with straight germ slit spore-length; perispore dehiscent in 10% KOH, smooth, epispore smooth.

Comments: *Annulohypoxylon bawanglingense* is similar to *A. moriforme* (Henn.) Y.M. Ju & al., which differs in its smaller (6–9 × 2.5–4 µm) spores (Ju & Rogers 1996). The new species resembles *A. microdiscum* (Y.M. Ju & J.D. Rogers) Sir & Kuhnert, which differs in its smaller (0.1–0.17 mm diam) discs surrounding the ostioles (Kuhnert & al. 2017).

Annulohypoxylon diaoluoshanense Wei Li bis & L. Guo, **sp. nov.** Figs 4–6

FN 570630

Differs from *Annulohypoxylon macrodiscum* by its thicker stromata.

Type: China, Hainan, Diaoluoshan, on wood, 26.IX.1958, RY. Zheng & al. 227 (**Holotype**, HMAS 29644).

Etymology: The epithet refers to the type locality, Diaoluoshan.

Stromata hemispherical, with inconspicuous to conspicuous perithecial mounds, 1.2–4 × 1–3.3 cm, 4–10 mm thick; surface blackish brown, blackish brown granules immediately beneath surface, with KOH-extractable greenish olivaceous pigment; the tissue below the perithecial layer blackish brown, conspicuous, 3–7 mm thick. Perithecia spherical or obovate, 0.8–1.2 mm diam.

Figs 1–9. ***Annulohypoxylon bawanglingense*** (HMAS 248019, holotype). 1. Stromata on wood; 2, 3. Ascospores. ***Annulohypoxylon diaoluoshanense*** (HMAS 29644, holotype). 4. Stromata on wood; 5, 6. Ascospores. ***Annulohypoxylon guangxiense*** (HMAS 33768, holotype). 7. Stromata on wood; 8, 9. Ascospores.

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6
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8
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9
10 um

Ostioles conical-papillate, encircled with a *truncatum*-type disc, 0.5–0.8 mm diam. Asci not seen. Ascospores dark brown, unicellular, ellipsoid-inequilateral, with broadly rounded ends, 8–11.5 × 4–5.5 μm, with straight germ slit spore-length; perispore dehiscent in 10% KOH, smooth, epispore smooth.

Comments: *Annulohypoxylon diaoluoshanense* is similar to *A. macrodiscum* Jad. Pereira & al., which differs in its thinner (0.8–1 mm thick) stroma and thinner tissue (0.3–0.5 mm thick) below the perithecial layer (Pereira & al. 2010).

Annulohypoxylon guangxiense Wei Li bis & L. Guo, **sp. nov.** Figs 7–9

FN 570633

Differs from *Annulohypoxylon archeri* by its tissues without apparent KOH-extractable pigments and its perispore indehiscent in 10% KOH.

Type: China, Guangxi, Donglan, on wood, 20.I.1958, LW. Xu 822 (**Holotype**, HMAS 33768).

Etymology: The epithet refers to the type locality, Guangxi Province.

Stromata pulvinate, with inconspicuous perithecial mounds; 1–4 × 0.6–1.8 cm, 0.5–1 mm thick; surface blackish brown, blackish brown granules immediately beneath surface and lacking KOH-extractable pigments; the tissue below the perithecial layer inconspicuous. Perithecia spherical, 0.4–0.5 mm diam. Ostioles papillate, encircled with a *truncatum*-type disc, 0.1–0.2 mm diam. Asci not seen. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 8–12.5 × 3–5 μm, with straight germ slit spore-length; perispore indehiscent in 10% KOH, smooth, epispore smooth.

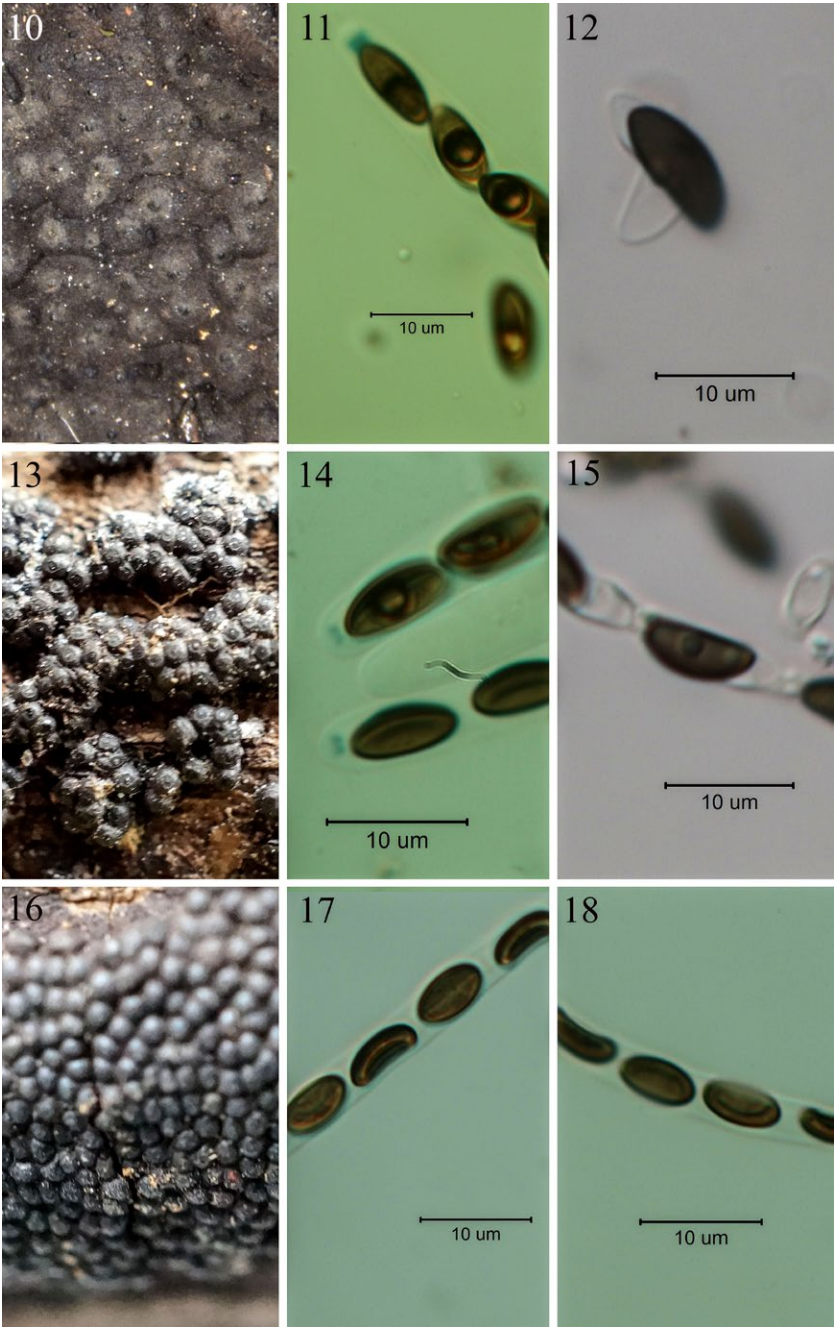
Comments: *Annulohypoxylon guangxiense* is similar to *A. archeri* (Berk.) Y.M. Ju & al, which differs in its tissues with KOH-extractable greenish olivaceous pigments and perispore dehiscent in 10% KOH (Ju & Rogers 1996).

Annulohypoxylon sichuanense Wei Li bis & L. Guo, **sp. nov.** Figs 10–12

FN 570632

Differs from *Annulohypoxylon multiforme* by its tissues with KOH-extractable pigments brown or reddish brown and its ostioles occasionally encircled with an inconspicuous *truncatum*-type disc.

Figs 10–18. ***Annulohypoxylon sichuanense*** (HMAS 281263, holotype). 10. Stromata on wood; 11, 12. Ascospores. ***Annulohypoxylon maeteangense*** (HMAS 247821). 13. Stromata on wood; 14, 15. Ascospores. ***Annulohypoxylon substygium*** (HMAS 247819). 16. Stromata on wood; 17, 18. Ascospores.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Type: China, Sichuan, Xiangtang, Hazhai, on decayed wood, 11.VIII.2013, W. Li & G. Huang 2278 (**Holotype**, HMAS 281263).

Etymology: The epithet refers to type locality, Sichuan Province.

Stromata peltate, with constricted base, usually confluent, with inconspicuous perithecial mounds, 1.8–2.3 × 1–1.7 cm, 1.5–5 mm thick; surface dark brown to blackish brown; blackish brown granules immediately beneath surface, with KOH-extractable brown or reddish brown pigment; the tissue below the perithecial layer conspicuous, blackish brown, 0.7–3 mm thick. Perithecia subspherical to obovate, 0.6–0.8 mm high, 0.3–0.7 mm broad. Ostioles conical-papillate, often without encircling disc or occasionally encircled with an inconspicuous *truncatum*-type disc, 0.1–0.2 mm diam. Asci 136–210 µm long overall, the spore-bearing parts 64–121 × 5–6 µm above 65–140 µm long stipes. Ascus apical ring bluing in Melzer's iodine reagent, discoid, 1–1.5 µm high, 2–2.5 µm diam. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 8–12 × 3.5–5 µm, with straight germ slit, shorter than spore-length; perispore dehiscent in 10% KOH, smooth, epispore smooth.

Comments: *Annulohypoxylon sichuanense* is similar to *A. multiforme* (Fr.) Y.M. Ju & al., which differs in its tissues with KOH-extractable greenish olivaceous pigments and ostioles without an encircling disc.

Annulohypoxylon maeteangense J. Fourn. & M. Stadler, Fungal Diversity 40: 32, 2010. Figs 13–15

Stromata irregularly pulvinate, with conspicuous perithecial mounds, 0.2–4 × 0.1–2.3 cm, 0.6–0.75 mm thick, often rosellinoid at the margins, surface dark brown to black with an olivaceous tones; olivaceous to brown granules immediately beneath surface, with KOH-extractable dull green pigment; the tissue below the perithecial layer inconspicuous, black. Perithecia spherical, 0.3–0.4 mm diam. Ostioles conical-papillate, black and shiny, encircled by a slightly concave *truncatum*-type disc, 0.15–0.25 mm diam. Asci 100–118 µm long overall, the spore-bearing parts 60–83 × 4–5 µm above 32–40 µm long stipes. Ascus apical ring bluing in Melzer's iodine reagent, discoid, 0.8–1 µm high, 1.5–2 µm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly to broadly rounded ends, 6.5–8.5 × 3–4 µm, with straight germ slit almost spore-length; perispore dehiscent in 10% KOH, smooth, epispore smooth.

Specimens examined: **CHINA**, **Hainan**, **Qionghai**, Niululing, alt. 116 m, on wood, 4.XII.2009, Y.F. Zhu & L. Guo 11 (HMAS 247821); **Wanning**, Shimeiwan, alt. 3 m, on wood, 6.XII.2009, Y.F. Zhu & L. Guo 53 (HMAS 255362).

Comments: Our specimens are morphologically similar to the holotype, but our asci have longer spore-bearing parts; in the holotype from Thailand they measure only 45–62 µm (Fournier & al. 2010).

Annulohypoxylon substygium Sir & Kuhnert, Fungal Diversity. 85:20, 2017.

Figs 16–18

Stromata pulvinate to effused-pulvinate, with inconspicuous perithecial mounds up to ½ exposed, 1–9 × 0.5–3 cm, 0.6–1.1 mm thick; surface black with reddish brown tones to black; black granules immediately beneath surface, with KOH-extractable light brownish black pigment; the tissue below the perithecial layer inconspicuous, black. Perithecia spherical to obovate, 0.4–0.7 mm high, 0.3–0.5 mm broad. Ostioles papillate, encircled by a *bovei*-type disc, 0.25–0.3 mm diam. Asci 96–110 µm total length, the spore-bearing parts 66–68 µm long, 4–4.5 µm broad, the stipes 30–46 µm long. Ascus apical ring weak bluing in Melzer's iodine reagent, discoid, 0.2–0.5 µm high, 1–1.5 µm broad. Ascospores light brown to brown, unicellular, ellipsoid nearly equilateral, with broadly rounded ends, 6.5–8 × 3–3.5 µm, with straight germ slit running almost the entire spore length; perispore dehiscent in 10% KOH, smooth, epispore smooth.

Specimens examined: **CHINA**, **Jiangsu**, **Jurong**, Baohuashan, on decayed wood, 15.IX.1935, H.N. Shen 101 (HMAS 9684); **Hainan**, Ledong, Jianfengling, alt. 850 m, 29.VII.2007, S.H. He 1173 (HMAS 255340); Changjiang, Bawangling, alt. 600 m, 10.V.2009, W. Li & X.Y. Liu 2234 (HMAS 247819); Bawangling, alt. 500 m, 17.II.2017, L. Guo 12136 (HMAS 255358).

Comments: In our specimens the tissue below the perithecial layer was inconspicuous, while it is conspicuous (0.5–0.6 mm thick) in the holotype (Kuhnert & al. 2017).

Discussion

Including the six species reported in this paper, we now recognize 26 *Annulohypoxylon* species in China (Teng 1963; Tai 1979; Bi & al. 1990; Ju & Rogers 1996, 1999; Ju & al. 2004; Ma 2011; Kuhnert & al. 2017).

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